

Prolog Programming Assignment #2: A Favorite Pokemon KB plus Simple List Processing Exercises

Learning Abstract

In this assignment we learn about establishing and interacting with a Pokemon Knowledge base, and then extending the KB and knowing some of the list processing exercises.

Task 1 - Pokemon

Part 1: Initial Pokemon KB

```
% -----  
% -----  
% --- File: pokemon.pro  
% --- Line: Just a few facts about pokemon  
% -----  
  
% -----  
% --- cen(P) :: Pokemon P was "creatio ex nihilo"  
  
cen(pikachu).  
cen(bulbasaur).  
cen(caterpie).  
cen(charmander).  
cen(vulpix).  
cen(poliwag).  
cen(squirtle).  
cen(staryu).  
  
% -----  
% --- evolves(P,Q) :: Pokemon P directly evolves to pokemon Q  
  
evolves(pikachu,raichu).  
evolves(bulbasaur,ivysaur).  
evolves(ivysaur,venusaur).  
evolves(caterpie,metapod).  
evolves(metapod,butterfree).  
evolves(charmander,charmeleon).  
evolves(charmeleon,charizard).  
evolves(vulpix,ninetails).
```

```

evolves(poliwag, poliwhirl).
evolves(poliwhirl, poliwrath).
evolves(squirtle, wartortle).
evolves(wartortle, blastoise).
evolves(staryu, starmie).

% -----
% --- pokemon(name(N), T, hp(H), attach(A, D)) :: There is a pokemon with
% --- name N, type T, hit point value H, and attack named A that does
% --- damage D.

pokemon(name(pikachu), electric, hp(60), attack(gnaw, 10)).
pokemon(name(raichu), electric, hp(90), attack(thunder-shock, 90)).

pokemon(name(bulbasaur), grass, hp(40), attack(leech-seed, 20)).
pokemon(name(ivysaur), grass, hp(60), attack(vine-whip, 30)).
pokemon(name(venusaur), grass, hp(140), attack(poison-powder, 70)).

pokemon(name(caterpie), grass, hp(50), attack(gnaw, 20)).
pokemon(name(metapod), grass, hp(70), attack(stun-spore, 20)).
pokemon(name(butterfree), grass, hp(130), attack(whirlwind, 80)).

pokemon(name(charmander), fire, hp(50), attack(scratch, 10)).
pokemon(name(charmeleon), fire, hp(80), attack(slash, 50)).
pokemon(name(charizard), fire, hp(170), attack(royal-blaze, 100)).

pokemon(name(vulpix), fire, hp(60), attack(confuse-ray, 20)).
pokemon(name(ninetails), fire, hp(100), attack(fire-blast, 120)).

pokemon(name(poliwag), water, hp(60), attack(water-gun, 30)).
pokemon(name(poliwhirl), water, hp(80), attack(amnesia, 30)).
pokemon(name(poliwrath), water, hp(140), attack(dashing-punch, 50)).

pokemon(name(squirtle), water, hp(40), attack(bubble, 10)).
pokemon(name(wartortle), water, hp(80), attack(waterfall, 60)).
pokemon(name(blastoise), water, hp(140), attack(hydro-pump, 60)).

pokemon(name(staryu), water, hp(40), attack(slap, 20)).
pokemon(name(starmie), water, hp(60), attack(star-freeze, 20)).

```

Part 2: Interaction demo with the Initial KB

?- cen(pikachu).
true.

?- cen(raichu).
false.

?- cen(Name).
Name = pikachu ;
Name = bulbasaur ;
Name = caterpie ;
Name = charmander ;
Name = vulpix ;
Name = poliwag ;
Name = squirtle ;
Name = staryu.

?- cen(A),write(A),nl,fail.
pikachu
bulbasaur
caterpie
charmander
vulpix
poliwag
squirtle
staryu
false.

?- evolves(squirtle,wartortle).
true.

?- evolves(wartotle,squirtle).
false.

?- evolves(squirtle,blastoise).
False.

?- evolves(X,Y),evolves(Y,Z).
X = bulbasaur,
Y = ivysaur,
Z = venusaur ;
X = caterpie,
Y = metapod,
Z = butterfree ;
X = charmander,

```
Y = charmeleon,  
Z = charizard ;  
X = poliwag,  
Y = poliwhirl,  
Z = poliwrath ;  
X = squirtle,  
Y = warturtle,  
Z = blastoise ;  
false.
```

```
?- evolves(X,Y),evolves(Y,Z),write(X),write( --> ),write(Z),nl,fail.  
bulbasaur-->venusaur  
caterpie-->butterfree  
charmander-->charizard  
poliwag-->poliwrath  
squirtle-->blastoise  
false.
```

```
?- pokemon(name(A),_,_),write(A),nl,fail.  
pikachu  
raichu  
bulbasaur  
ivysaur  
venusaur  
caterpie  
metapod  
butterfree  
charmander  
Charmeleon  
Charizard  
vulpix  
ninetails  
poliwag  
poliwhirl  
poliwrath  
squirtle  
warturtle  
blastoise  
staryu  
starmie  
false.
```

```
?- pokemon(name(A),fire,_,_),write(A),nl,fail.  
charmander
```

charmeleon
charizard
vulpix
ninetails
false.

?- pokemon(name(A),B,_,_),write("nks(name(",write(A),write("),kind(",write(B),write(")")),nl,fail.
nks(name(pikachu),kind(electric))
nks(name(raichu),kind(electric))
nks(name(bulbasaur),kind(grass))
nks(name(ivysaur),kind(grass))
nks(name(venusaur),kind(grass))
nks(name(caterpie),kind(grass))
nks(name(metapod),kind(grass))
nks(name(butterfree),kind(grass))
nks(name(charmander),kind(fire))
nks(name(charmeleon),kind(fire))
nks(name(charizard),kind(fire))
nks(name(vulpix),kind(fire))
nks(name(ninetails),kind(fire))
nks(name(poliwag),kind(water))
nks(name(poliwhirl),kind(water))
nks(name(poliwrath),kind(water))
nks(name(squirtle),kind(water))
nks(name(wartortle),kind(water))
nks(name(blastoise),kind(water))
nks(name(staryu),kind(water))
nks(name(starmie),kind(water))
false.

?- pokemon(name(A),_,_,attack(waterfall,_)).
A = wartortle ;

?- pokemon(name(N),_,_,attack(poison-powder,_)).
N = venusaur .

?- pokemon(_,water,_,attack(N,_)),write(N),nl,fail.
water-gun
amnesia
dashing-punch
bubble
waterfall
hydro-pump

slap
star-freeze
false.

?- pokemon(name(poliwhirl),_,hp(HP),_).
HP = 80

?- pokemon(name(butterfree),_,hp(HP),_).
HP = 130.

?- pokemon(name(A),_,hp(HP),_),HP>85,write(A),nl,fail.
raichu
venusaur
butterfree
charizard
ninetails
poliwrath
blastoise
false.

?- pokemon(name(A),_,_,attack(_,B)),B>60,write(A),nl,fail.
raichu
venusaur
butterfree
charizard
ninetails
false.

?- cen(A),pokemon(name(A),_,hp(B),_),write(A),write(": "),write(B),nl,fail.
pikachu: 60
bulbasaur: 40
caterpie: 50
charmander: 50
vulpix: 60
poliwag: 60
squirtle: 40
staryu: 40
false.

Part 3: KB Extension

% -----
% -----

```

% --- File: pokemon.pro
% --- Line: Just a few facts about pokemon
% -----

% -----
% --- cen(P) :: Pokemon P was "creatio ex nihilo"

cen(pikachu).
cen(bulbasaur).
cen(caterpie).
cen(charmander).
cen(vulpix).
cen(poliwag).
cen(squirtle).
cen(staryu).

% -----
% --- evolves(P,Q) :: Pokemon P directly evolves to pokemon Q

evolves(pikachu,raichu).
evolves(bulbasaur,ivysaur).
evolves(ivysaur,venusaur).
evolves(caterpie,metapod).
evolves(metapod,butterfree).
evolves(charmander,charmeleon).
evolves(charmeleon,charizard).
evolves(vulpix,ninetails).
evolves(poliwag,poliwhirl).
evolves(poliwhirl,poliwrath).
evolves(squirtle,wartortle).
evolves(wartortle,blastoise).
evolves(staryu,starmie).

% -----
% --- pokemon(name(N),T,hp(H),attach(A,D)) :: There is a pokemon with
% --- name N, type T, hit point value H, and attach named A that does
% --- damage D.

pokemon(name(pikachu), electric, hp(60), attack(gnaw, 10)).
pokemon(name(raichu), electric, hp(90), attack(thunder-shock, 90)).

pokemon(name(bulbasaur), grass, hp(40), attack(leech-seed, 20)).
pokemon(name(ivysaur), grass, hp(60), attack(vine-whip, 30)).
pokemon(name(venusaur), grass, hp(140), attack(poison-powder, 70)).

```

```

pokemon(name(caterpie), grass, hp(50), attack(gnaw, 20)).
pokemon(name(metapod), grass, hp(70), attack(stun-spore, 20)).
pokemon(name(butterfree), grass, hp(130), attack(whirlwind, 80)).

```

```

pokemon(name(charmander), fire, hp(50), attack(scratch, 10)).
pokemon(name(charmeleon), fire, hp(80), attack(slash, 50)).
pokemon(name(charizard), fire, hp(170), attack(royal-blaze, 100)).

```

```

pokemon(name(vulpix), fire, hp(60), attack(confuse-ray, 20)).
pokemon(name(ninetails), fire, hp(100), attack(fire-blast, 120)).

```

```

pokemon(name(poliwag), water, hp(60), attack(water-gun, 30)).
pokemon(name(poliwhirl), water, hp(80), attack(amnesia, 30)).
pokemon(name(poliwrath), water, hp(140), attack(dashing-punch, 50)).

```

```

pokemon(name(squirtle), water, hp(40), attack(bubble, 10)).
pokemon(name(wartortle), water, hp(80), attack(waterfall, 60)).
pokemon(name(blastoise), water, hp(140), attack(hydro-pump, 60)).

```

```

pokemon(name(staryu), water, hp(40), attack(slap, 20)).
pokemon(name(starmie), water, hp(60), attack(star-freeze, 20)).

```

```

display_cen_names :- cen(A),write(A),nl,fail.
display_not_cen_names :- evolves(_,A),write(A),nl,fail.
generator(A,B) :- pokemon(name(A),B,_,_).
display_names :- pokemon(name(A),_,_,_),write(A),nl,fail.
display_attacks :- pokemon(_,_,_,attack(A,_)),write(A),nl,fail.
display_cen_attacks :- cen(A),pokemon(name(A),_,_,attack(B,_)),write(B),nl,fail.
indicate_attack(A) :- pokemon(name(A),_,_,attack(B,_)),write(A),write(" -> "),write(B).
indicate_attacks :- pokemon(name(A),_,_,attack(B,_)),write(A),write(" -> "),write(B),nl,fail.
powerful(Name) :- pokemon(name(Name),_,_,attack(_,B)),B>55.
tough(Name) :- pokemon(name(Name),_,hp(B),_),B>100.
awesome(Name) :- pokemon(name(Name),_,hp(A),attack(_,B)),A>100,B>55.
powerful_but_vulnerable(A) :- pokemon(name(A),_,hp(B),attack(_,C)),C > 55,B =< 100.
type(A,Type) :- pokemon(name(A),Type,_,_).
dump_kind(B) :- pokemon(A,B,C,D),write(pokemon(A,B,C,D)),nl,fail.
family(A) :- evolves(A,B),evolves(B,C),write(A),write(" "),write(B),write(" "),write(C).
family(A) :- evolves(A,B),write(A),write(" "),write(B).
families :-cen(A),evolves(A,B),nl,write(A),write(" "),write(B),evolves(B,C),write(" "),write(C),fail.
lineage(A) :-
pokemon(name(A),B,C,D),write(pokemon(name(A),B,C,D)),nl,evolves(A,F),pokemon(name(F),G,H,I),write(pokemon(name(F),G,H,I)),nl,evolves(F,K),pokemon(name(K),L,M,N),write(pokemon(name(K),L,M,N))
.

```

Part 4: Interaction demo with the Augmented KB

?- display_cen_names.

pikachu

bulbasaur

caterpie

charmander

vulpix

poliwhag

squirtle

staryu

true.

?- display_not_cen_names.

raichu

ivysaur

venusaur

metapod

butterfree

charmeleon

charizard

ninetails

poliwhirl

poliwrath

wartortle

blastoise

starmie

true.

?- generator(Name,fire).

Name = charmander ;

Name = vulpix ;

false.

?- generator(Name,water).

Name = poliwhag ;

Name = squirtle ;

Name = staryu ;

false.

?- generator(Name,electric).

Name = pikachu ;

false.

```
?- generator(Name,grass).  
Name = bulbasaur ;  
Name = caterpie ;  
false.
```

```
?- display_names.  
pikachu  
raichu  
bulbasaur  
ivysaur  
venusaur  
caterpie  
metapod  
butterfree  
charmander  
charmeleon  
charizard  
vulpix  
ninetails  
poliwag  
poliwhirl  
poliwrath  
squirtle  
wartortle  
blastoise  
staryu  
starmie  
true.
```

```
?- display_attacks.  
gnaw  
thunder-shock  
leech-seed  
vine-whip  
poison-powder  
gnaw  
stun-spore  
whirlwind  
scratch  
slash  
royal-blaze  
confuse-ray  
fire-blast
```

water-gun
amnesia
dashing-punch
bubble
waterfall
hydro-pump
slap
star-freeze
true.

?- display_cen_attacks.

gnaw
leech-seed
gnaw scratch
confuse-ray
water-gun
bubble
slap
true.

?- indicate_attack(charmander).

charmander --> scratch true

?- indicate_attack(bulbasaur).

bulbasaur --> leech-seed true

?- indicate_attacks.

pikachu --> gnaw
raichu --> thunder-shock
bulbasaur --> leech-seed
ivysaur --> vine-whip
venusaur --> poison-powder
caterpie --> gnaw
metapod --> stun-spore
butterfree --> whirlwind
charmander --> scratch
charmeleon --> slash
charizard --> royal-blaze
vulpix --> confuse-ray
ninetails --> fire-blast
poliwag --> water-gun
poliwhirl --> amnesia
poliwrath --> dashing-punch
squirtle --> bubble

wartortle --> waterfall
blastoise --> hydro-pump
staryu --> slap
starmie --> star-freeze
true.

?- powerful(Name).
Name = raichu ;
Name = venusaur ;
Name = butterfree ;
Name = charizard ;
Name = ninetails ;
Name = wartortle ;
Name = blastoise ;
false.

?- tough(Name).
Name = venusaur ;
Name = butterfree ;
Name = charizard ;
Name = poliwrath ;
Name = blastoise ;
false.

?- awesome(Name).
Name = venusaur ;
Name = butterfree ;
Name = charizard ;
Name = blastoise ;
false.

?- powerful_but_vulnerable(Name).
Name = raichu ;
Name = ninetails ;
Name = wartortle ;
false.

?- type(squirtle,Type).
Type = water

?- type(caterpie,Type).
Type = grass

?- type(Name,fire),write(Name),nl,fail.

charmander
charmeleon
charizard
vulpix
ninetails
false.

?- dump_kind(water).

pokemon(name(poliwag),water,hp(60),attack(water-gun,30))
pokemon(name(poliwhirl),water,hp(80),attack(amnesia,30))
pokemon(name(poliwrath),water,hp(140),attack(dashing-punch,50))
pokemon(name(squirtle),water,hp(40),attack(bubble,10))
pokemon(name(wartortle),water,hp(80),attack(waterfall,60))
pokemon(name(blastoise),water,hp(140),attack(hydro-pump,60))
pokemon(name(staryu),water,hp(40),attack(slap,20))
pokemon(name(starmie),water,hp(60),attack(star-freeze,20))
true.

?- dump_kind(grass).

pokemon(name(bulbasaur),grass,hp(40),attack(leech-seed,20))
pokemon(name(ivysaur),grass,hp(60),attack(vine-whip,30))
pokemon(name(venusaur),grass,hp(140),attack(poison-powder,70))
pokemon(name(caterpie),grass,hp(50),attack(gnaw,20))
pokemon(name(metapod),grass,hp(70),attack(stun-spore,20))
pokemon(name(butterfree),grass,hp(130),attack(whirlwind,80))
true.

?- family(pikachu).

pikachu raichu
true

?- family(bulbasaur).

bulbasaur ivysaur venusaur
true.

?- family(caterpie).

caterpie metapod butterfree
true.

?- families.

pikachu raichu
bulbasaur ivysaur venusaur
caterpie metapod butterfree
charmander charmeleon charizard

```
vulpix ninetails
poliwhirl poliwhirl poliwrath
squirtle wartortle blastoise
staryu starmie
true.
```

```
?- lineage(pikachu).
pokemon(name(pikachu),electric,hp(60),attack(gnaw,10))
pokemon(name(raichu),electric,hp(90),attack(thunder-shock,90))
true
```

```
?- lineage(squirtle).
pokemon(name(squirtle),water,hp(40),attack(bubble,10))
pokemon(name(wartortle),water,hp(80),attack(waterfall,60))
pokemon(name(blastoise),water,hp(140),attack(hydro-pump,60))
true
```

```
?- lineage(wartortle).
pokemon(name(wartortle),water,hp(80),attack(waterfall,60))
pokemon(name(blastoise),water,hp(140),attack(hydro-pump,60)) true
```

```
?- lineage(blastoise).
pokemon(name(blastoise),water,hp(140),attack(hydro-pump,60))
true.
```

```
?- lineage(charmander).
pokemon(name(charmander),fire,hp(50),attack(scratch,10))
pokemon(name(charmeleon),fire,hp(80),attack(slash,50))
pokemon(name(charizard),fire,hp(170),attack(royal-blaze,100))
true
```

Part 5: KB Augmented by 12 Pokemon

```
% -----
% -----
% --- File: pokemon.pro
% --- Line: Just a few facts about pokemon
% -----

% -----
% --- cen(P) :: Pokemon P was "creatio ex nihilo"
```

```
cen(pikachu).
cen(bulbasaur).
cen(caterpie).
cen(charmander).
cen(vulpix).
cen(poliwag).
cen(squirtle).
cen(staryu).
cen(pidgey).
cen(mankey).
cen(gastly).
cen(rhyhorn).
```

```
% -----
% --- evolves(P,Q) :: Pokemon P directly evolves to pokemon Q
evolves(mankey,primeape).
evolves(primeape,annihilape).
evolves(pidgey,pidgeotto).
evolves(pidgeotto,pidgeot).
evolves(gastly,haunter).
evolves(haunter,gengar).
evolves(rhyhorn,rhydon).
evolves(rhydon,rhyperior).
evolves(pikachu,raichu).
evolves(bulbasaur,ivysaur).
evolves(ivysaur,venusaur).
evolves(caterpie,metapod).
evolves(metapod,butterfree).
evolves(charmander,charmeleon).
evolves(charmeleon,charizard).
evolves(vulpix,ninetails).
evolves(poliwag,poliwhirl).
evolves(poliwhirl,poliwrath).
evolves(squirtle,wartortle).
evolves(wartortle,blastoise).
evolves(staryu,starmie).
```

```
% -----
% --- pokemon(name(N),T,hp(H),attach(A,D)) :: There is a pokemon with
% --- name N, type T, hit point value H, and attach named A that does
% --- damage D.
```

```
pokemon(name(mankey), fighting, hp(40), attack(thrash, 80)).
pokemon(name(primeape), fighting, hp(65), attack(chase, 105)).
```

pokemon(name(annihilape), fighting, hp(110), attack(fist-imbue, 115)).

pokemon(name(pidgey), flying, hp(40), attack(kick-up-sand, 45)).

pokemon(name(pidgeotto), flying, hp(63), attack(search-prey, 60)).

pokemon(name(pidgeot), flying, hp(83), attack(talons-attack, 80)).

pokemon(name(gastly), ghost, hp(30), attack(poison, 35)).

pokemon(name(haunter), ghost, hp(45), attack(poison-shudder, 50)).

pokemon(name(gengar), ghost, hp(60), attack(pre-shadow, 65)).

pokemon(name(rhyhorn), ground, hp(80), attack(shatter, 85)).

pokemon(name(rhydon), ground, hp(105), attack(punch-hole, 130)).

pokemon(name(rhyperior), ground, hp(115), attack(3-projectile, 140)).

pokemon(name(pikachu), electric, hp(60), attack(gnaw, 10)).

pokemon(name(raichu), electric, hp(90), attack(thunder-shock, 90)).

pokemon(name(bulbasaur), grass, hp(40), attack(leech-seed, 20)).

pokemon(name(ivysaur), grass, hp(60), attack(vine-whip, 30)).

pokemon(name(venusaur), grass, hp(140), attack(poison-powder, 70)).

pokemon(name(caterpie), grass, hp(50), attack(gnaw, 20)).

pokemon(name(metapod), grass, hp(70), attack(stun-spore, 20)).

pokemon(name(butterfree), grass, hp(130), attack(whirlwind, 80)).

pokemon(name(charmander), fire, hp(50), attack(scratch, 10)).

pokemon(name(charmeleon), fire, hp(80), attack(slash, 50)).

pokemon(name(charizard), fire, hp(170), attack(royal-blaze, 100)).

pokemon(name(vulpix), fire, hp(60), attack(confuse-ray, 20)).

pokemon(name(ninetails), fire, hp(100), attack(fire-blast, 120)).

pokemon(name(poliwag), water, hp(60), attack(water-gun, 30)).

pokemon(name(poliwhirl), water, hp(80), attack(amnesia, 30)).

pokemon(name(poliwrath), water, hp(140), attack(dashing-punch, 50)).

pokemon(name(squirtle), water, hp(40), attack(bubble, 10)).

pokemon(name(wartortle), water, hp(80), attack(waterfall, 60)).

pokemon(name(blastoise), water, hp(140), attack(hydro-pump, 60)).

pokemon(name(staryu), water, hp(40), attack(slap, 20)).

pokemon(name(starmie), water, hp(60), attack(star-freeze, 20)).

```
display_cen_names :- cen(A),write(A),nl,fail.
display_not_cen_names :- evolves(_,A),write(A),nl,fail.
generator(A,B) :- pokemon(name(A),B,_,_).
display_names :- pokemon(name(A),_,_,_),write(A),nl,fail.
display_attacks :- pokemon(_,_,_,attack(A,_)),write(A),nl,fail.
display_cen_attacks :- cen(A),pokemon(name(A),_,_,attack(B,_)),write(B),nl,fail.
indicate_attack(A) :- pokemon(name(A),_,_,attack(B,_)),write(A),write(" -> "),write(B).
indicate_attacks :- pokemon(name(A),_,_,attack(B,_)),write(A),write(" -> "),write(B),nl,fail.
powerful(Name) :- pokemon(name(Name),_,_,attack(_,B)),B>55.
tough(Name) :- pokemon(name(Name),_,hp(B),_),B>100.
awesome(Name) :- pokemon(name(Name),_,hp(A),attack(_,B)),A>100,B>55.
powerful_but_vulnerable(A) :- pokemon(name(A),_,hp(B),attack(_,C)),C > 55,B =< 100.
type(A,Type) :- pokemon(name(A),Type,_,_).
dump_kind(B) :- pokemon(A,B,C,D),write(pokemon(A,B,C,D)),nl,fail.
family(A) :- evolves(A,B),evolves(B,C),write(A),write(" "),write(B),write(" "),write(C).
family(A) :- evolves(A,B),write(A),write(" "),write(B).
families :-cen(A),evolves(A,B),nl,write(A),write(" "),write(B),evolves(B,C),write(" "),write(C),fail.
lineage(A) :-
pokemon(name(A),B,C,D),write(pokemon(name(A),B,C,D)),nl,evolves(A,F),pokemon(name(F),G,H,I),write(pokemon(name(F),G,H,I)),nl,evolves(F,K),pokemon(name(K),L,M,N),write(pokemon(name(K),L,M,N))
.
```

Part 6: Interaction demo with the KB Augmented by 12 Pokemon

?- display_cen_names.

pikachu

bulbasaur

caterpie

charmander

vulpix

poliwag

squirtle

staryu

pidgey

mankey

gastly

rhyhorn

false.

?- display_not_cen_names.

primeape

annihilape

pidgeotto

pidgeot

haunter

gengar

rhydon

rhyperior

raichu

ivysaur

venusaur

metapod

butterfree

charmeleon

charizard

ninetails

poliwhirl

poliwrath

wartortle

blastoise

starmie

false.

?- generator(Name,fire).

Name = charmander ;

Name = vulpix ;

false.

?- generator(Name,ground).

Name = rhyhorn ;

false.

?- generator(Name,grass).

Name = bulbasaur ;

Name = caterpie ;

false.

?- display_names.

mankey

primeape

annihilape

pidgey

pidgeotto

pidgeot

gastly

haunter

genger

rhyhorn

rhydon

rhyperior

pikachu

raichu

bulbasaur

ivysaur

venusaur

caterpie

metapod

butterfree

charmander

charmeleon

charizard

vulpix

ninetails

poliwag

poliwhirl

poliwrath

squirtle

wartortle

blastoise

staryu

starmie

false.

?- display_attacks.

thrash

chase

fist-imbue

kick-up-sand

search-prey

talons-attack

poison

poison-shudder

prey-shadow

shatter

punch-hole
3-projectile
gnaw
thunder-shock
leech-seed
vine-whip
poison-powder
gnaw
stun-spore
whirlwind
scratch
slash
royal-blaze
confuse-ray
fire-blast
water-gun
amnesia
dashing-punch
bubble
waterfall
hydro-pump
slap
star-freeze
false.

?- display_cen_attacks.

gnaw
leech-seed
gnaw
scratch
confuse-ray
water-gun
bubble
slap
kick-up-sand
thrash
poison
shatter
false.

?- indicate_attack(charmander).

charmander -> scratch
true .

?- indicate_attack(mankey).
mankey -> thrash
true .

?- indicate_attacks.
mankey -> thrash
primeape -> chase
annihilape -> fist-imbue
pidgey -> kick-up-sand
pidgeotto -> search-prey
pidgeot -> talons-attack
gastly -> poison
haunter -> poison-shudder
genger -> prey-shadow
rhyhorn -> shatter
rhydon -> punch-hole
rhyperior -> 3-projectile
pikachu -> gnaw
raichu -> thunder-shock
bulbasaur -> leech-seed
ivysaur -> vine-whip
venusaur -> poison-powder
caterpie -> gnaw
metapod -> stun-spore
butterfree -> whirlwind
charmander -> scratch
charmeleon -> slash
charizard -> royal-blaze
vulpix -> confuse-ray
ninetails -> fire-blast
poliwag -> water-gun
poliwhirl -> amnesia
poliwrath -> dashing-punch
squirtle -> bubble
wartortle -> waterfall
blastoise -> hydro-pump
staryu -> slap
starmie -> star-freeze
false.

?- powerful(Name).
Name = mankey ;
Name = primeape ;
Name = annihilape ;

Name = pidgeotto ;
Name = pidgeot ;
Name = genger ;
Name = rhyhorn ;
Name = rhydon ;
Name = rhyperior ;
Name = raichu ;
Name = venusaur ;
Name = butterfree ;
Name = charizard ;
Name = ninetails ;
Name = wartortle ;
Name = blastoise ;
false.

?- tough(Name).
Name = annihilape ;
Name = rhydon ;
Name = rhyperior ;
Name = venusaur ;
Name = butterfree ;
Name = charizard ;
Name = poliwrath ;
Name = blastoise ;
false.

?- awesome(Name).
Name = annihilape ;
Name = rhydon ;
Name = rhyperior ;
Name = venusaur ;
Name = butterfree ;
Name = charizard ;
Name = blastoise ;
false.

?- powerful_but_vulnerable(Name).
Name = mankey ;
Name = primeape ;
Name = pidgeotto ;
Name = pidgeot ;
Name = genger ;
Name = rhyhorn ;
Name = raichu ;

```
Name = ninetails ;
Name = wartortle ;
false.
```

```
?- type(squirtle,Type).
Type = water.
```

```
?- type(rhyhorn,Type).
Type = ground.
```

```
?- type(Name,ground),write(Name),nl,fail.
rhyhorn
rhydon
rhyperior
false.
```

```
?- dump_kind(water).
pokemon(name(poliwag),water,hp(60),attack(water-gun,30))
pokemon(name(poliwhirl),water,hp(80),attack(amnesia,30))
pokemon(name(poliwrath),water,hp(140),attack(dashing-punch,50))
pokemon(name(squirtle),water,hp(40),attack(bubble,10))
pokemon(name(wartortle),water,hp(80),attack(waterfall,60))
pokemon(name(blastoise),water,hp(140),attack(hydro-pump,60))
pokemon(name(staryu),water,hp(40),attack(slap,20))
pokemon(name(starmie),water,hp(60),attack(star-freeze,20))
false.
```

```
?- dump_kind(flying).
pokemon(name(pidghey),flying,hp(40),attack(kick-up-sand,45))
pokemon(name(pidgeotto),flying,hp(63),attack(search-prey,60))
pokemon(name(pidgeot),flying,hp(83),attack(talons-attack,80))
false.
```

```
?- family(pikachu).
pikachu raichu
true.
```

```
?- family(pidghey).
pidghey pidgeotto pidgeot
true .
```

```
?- families.
```

```
pikachu raichu
```

bulbasaur ivysaur venusaur
caterpie metapod butterfree
charmander charmeleon charizard
vulpix ninetails
poliwag poliwhirl poliwrath
squirtle wartortle blastoise
staryu starmie
pidgey pidgeotto pidgeot
mankey primeape annihilape
gastly haunter gengar
rhyhorn rhydon rhyperior
false.

?- lineage(pikachu).
pokemon(name(pikachu),electric,hp(60),attack(gnaw,10))
pokemon(name(raichu),electric,hp(90),attack(thunder-shock,90))
false.

?- lineage(rhyhorn).
pokemon(name(rhyhorn),ground,hp(80),attack(shatter,85))
pokemon(name(rhydon),ground,hp(105),attack(punch-hole,130))
pokemon(name(rhyperior),ground,hp(115),attack(3-projectile,140))
True.

Task 2 - List Processing

Head/Tail Exercises

?- [H|T] = [red, yellow, blue, green].
H = red,
T = [yellow, blue, green].

?- [H, T] = [red, yellow, blue, green].
false.

?- [F|_] = [red, yellow, blue, green].
F = red.

?- [_|[S|_]] = [red, yellow, blue, green].
S = yellow.

?- [F|[S|R]] = [red, yellow, blue, green].

F = red,
S = yellow,
R = [blue, green].

?- List = [this|[and, that]].
List = [this, and, that].

?- List = [this, and, that].
List = [this, and, that].

?- [a,[b, c]] = [a, b, c].
false.

?- [a|[b, c]] = [a, b, c].
true.

?- [cell(Row,Column)|Rest] = [cell(1,1), cell(3,2), cell(1,3)].
Row = Column, Column = 1,
Rest = [cell(3, 2), cell(1, 3)].

?- [X|Y] = [one(un, uno), two(dos, deux), three(trois, tres)].
X = one(un, uno),
Y = [two(dos, deux), three(trois, tres)].

List Processing Code

```
first([H|_],H).
rest([_|T],T).
last([_|_],L).
last([_|T],Result) :- last(T,Result).
nth(0,[T|_],T).
nth(A,[_|T],Result):- B is A-1, nth(B,T,Result).
writelist([]).
writelist([H|T]) :- write(H),nl,writelist(T).
sum([],0).
sum([H|T],sm):-sum(T,a),sm is a+H.
add_first(X,L,[X|L]).
add_last(X,[],[X]).
add_last(X,[H|T],[H|TX]) :- add_last(X,T,TX).
iota(0,[]).
iota(N,IotaN) :-
K is N - 1,
```

```
iota(K,IotaK),
add_last(N,IotaK,IotaN).
```

```
pick(L,Item):-
length(L,Length),
random(0,Length,RN),
nth(RN,L,Item).
```

```
make_set([],[]).
make_set([H|T],TS) :-
member(H,T),
make_set(T,TS).
make_set([H|T],[H|TS]) :-
make_set(T,TS).
```

```
product([],1).
product([H|T],P) :- product(T,S),P is H * S.
```

```
make_list(0,_,[]).
make_list(N,A,P):-
K is N - 1,
make_list(K,A,Q),
add_last(A,Q,P).
```

```
but_first([_|T],T).
```

```
but_last([_|[]],[]).
but_last([H|T],A):- but_last(T,S),add_first(H,S,A).
```

```
is_palindrome([]).
is_palindrome([_|[]]).
is_palindrome([H|T]):-
first([H|T],A),last([H|T],B),A = B,but_first([H|T],S),but_last(S,P),is_palindrome(P).
```

```
noun_phrase(A):- pick([red, happy, shocked, fun, excited, confident],M), pick([ guy, student, accountant,
grandma, sun, mathematician, genius, athlete],N),append([the],[M],O) ,append(O,[N],A).
```

```
sentence(A):-noun_phrase(M),pick([loved, trusted, surpassed, found, took, created, shouted,
enlightened],N),noun_phrase(O),append(M,[N],B),append(B,O,A).
```

Demo for Example List Processors

?- first([apple],First).
First = apple.

?- first([c,d,e,f,g,a,b],P).
P = c.

?- rest([apple],Rest).
Rest = [].

?- rest([c,d,e,f,g,a,b],Rest).
Rest = [d, e, f, g, a, b].

?- last([peach],Last).
Last = peach

?- last([c,d,e,f,g,a,b],P).
P=b

?- nth(0,[zero,one,two,three,four],Element).
Element = zero

?- nth(3,[four,three,two,one,zero],Element).
Element = one

?- writelist([red,yellow,blue,green,purple,orange]).
red yellow blue green purple orange
true.

?- sum([],Sum). Sum = 0. ?- sum([2,3,5,7,11],SumOfPrimes).
SumOfPrimes = 28.

?- add_first(thing,[],Result).
Result = [thing].

?- add_first(racket,[prolog,haskell,rust],Languages).
Languages = [racket, prolog, haskell, rust].

?- add_last(thing,[],Result).
Result = [thing]

?- add_last(rust,[racket,prolog,haskell],Languages).
Languages = [racket, prolog, haskell, rust]

?- iota(5,Iota5).

Iota5 = [1, 2, 3, 4, 5]

?- iota(9,Iota9).

Iota9 = [1, 2, 3, 4, 5, 6, 7, 8, 9] ?-

pick([cherry,peach,apple,blueberry],Pie).

Pie = blueberry

?- pick([cherry,peach,apple,blueberry],Pie).

Pie = cherry

?- pick([cherry,peach,apple,blueberry],Pie).

Pie = cherry

?- pick([cherry,peach,apple,blueberry],Pie).

Pie = apple

\?- pick([cherry,peach,apple,blueberry],Pie).

Pie = peach

?- pick([cherry,peach,apple,blueberry],Pie).

Pie = apple

?- pick([cherry,peach,apple,blueberry],Pie).

Pie = cherry

?- pick([cherry,peach,apple,blueberry],Pie).

Pie = blueberry

?- make_set([1,1,2,1,2,3,1,2,3,4],Set).

Set = [1, 2, 3, 4]

?- make_set([bit,bot,bet,bot,bot,bit],B).

B = [bet, bot, bit]

Demo for List Processing Exercises

?- product([],P).

P = [].

?- product([1,3,5,7,9],Product).

Product = 945.

?- iota(9,Iota),product(Iota,Product).

Iota = [1, 2, 3, 4, 5, 6, 7, 8, 9],

Product = 362880 .

?- make_list(7,seven,Seven).

Seven = [seven, seven, seven, seven, seven, seven, seven] .

?- make_list(8,2,List).

List = [2, 2, 2, 2, 2, 2, 2, 2] .

?- but_first([a,b,c],X).

X = [b, c].

?- but_last([a,b,c,d,e],X).

X = [a, b, c, d] .

?- is_palindrome([x]).

true .

?- is_palindrome([a,b,c]).

false.

?- is_palindrome([a,b,b,a]).

true .

?- is_palindrome([1,2,3,4,5,4,2,3,1]).

false.

?- is_palindrome([c,o,f,f,e,e,e,f,o,c]).

true .

?- noun_phrase(NP).

NP = [the, excited, athlete] .

?- noun_phrase(NP).

NP = [the, red, student] .

?- noun_phrase(NP).

NP = [the, shocked, accountant] .

?- noun_phrase(NP).

NP = [the, fun, accountant] .

?- noun_phrase(NP).

NP = [the, red, athlete] .

?- sentence(S).

S = [the, red, sun, surpassed, the, happy, grandma] .

?- sentence(S).

S = [the, happy, genius, shouted, the, confident, sun] .

?- sentence(S).

S = [the, excited, genius, found, the, confident, grandma] .

?- sentence(S).

S = [the, happy, mathematician, took, the, fun, sun] .

?- sentence(S).

S = [the, happy, grandma, surpassed, the, red, guy] .

?- sentence(S).

S = [the, shocked, sun, created, the, confident, guy] .

?- sentence(S).

S = [the, confident, student, shouted, the, shocked, genius] .

?- sentence(S).

S = [the, shocked, mathematician, took, the, shocked, athlete] .

?- sentence(S).

S = [the, excited, guy, enlightened, the, shocked, athlete] .

?- sentence(S).

S = [the, shocked, genius, enlightened, the, confident, accountant] .

?- sentence(S).

S = [the, red, accountant, took, the, excited, mathematician] .

?- sentence(S).

S = [the, fun, student, trusted, the, confident, student] .

?- sentence(S).

S = [the, fun, athlete, trusted, the, shocked, guy] .

?- sentence(S).

S = [the, excited, mathematician, created, the, happy, genius] .

?- sentence(S).

S = [the, confident, athlete, took, the, excited, guy] .

?- sentence(S).

S = [the, confident, athlete, enlightened, the, excited, sun] .

?-